Flipping Physics Lecture Notes:

Everybody Brought Mass to the Party!

You have to be able to identify when mass cancels out of an equation.

Example #1:

$$mg\cos\theta - \mu_k mg\sin\theta = ma \Rightarrow \frac{mg\cos\theta}{m} - \frac{\mu_k mg\sin\theta}{m} = \frac{ma}{m} \Rightarrow g\cos\theta - \mu_k g\sin\theta = a$$

The "equation" is the party and the individuals are delineated by a subtraction, addition or equal sign. "Everybody" brought mass to the party! "mgcosθ" brought mass. "$\mu_k$mgsinθ" brough mass. "ma" brought mass. Therefore we can be equitable and take mass from everybody.

Example #2:

$$0 = \mu_k mg\sin\theta + mgh \Rightarrow \frac{0}{m} = \frac{\mu_k mg\sin\theta}{m} + \frac{mgh}{m} \Rightarrow 0 = \mu_k g\sin\theta + gh$$

Zero is nobody and because $\frac{0}{m} = 0$, we can take mass from nobody. Everybody brought mass to the party!

Example #3:

$$mgh + \frac{1}{2}mv^2 = 4kx^2 \Rightarrow \frac{mgh}{m} + \frac{\frac{1}{2}mv^2}{m} = \frac{\frac{1}{2}kx^2}{m} \Rightarrow gh + \frac{v^2}{2} = \frac{kx^2}{2m}$$

$\frac{1}{2}kx^2$ didn't bring mass to the party, so we can't take mass from everybody.
Everybody did *not* bring mass to the party. ☹

Example #4:

$$\frac{1}{2}mv_i^2 = \frac{1}{2}mv_f^2 + mgL\left(1-\cos\theta\right) \Rightarrow \frac{\frac{1}{2}mv_i^2}{m} = \frac{\frac{1}{2}mv_f^2}{m} + \frac{mgL\left(1-\cos\theta\right)}{m} \Rightarrow \frac{1}{2}v_i^2 = \frac{1}{2}v_f^2 + gL\left(1-\cos\theta\right)$$

Everybody brought mass to the party! ☺